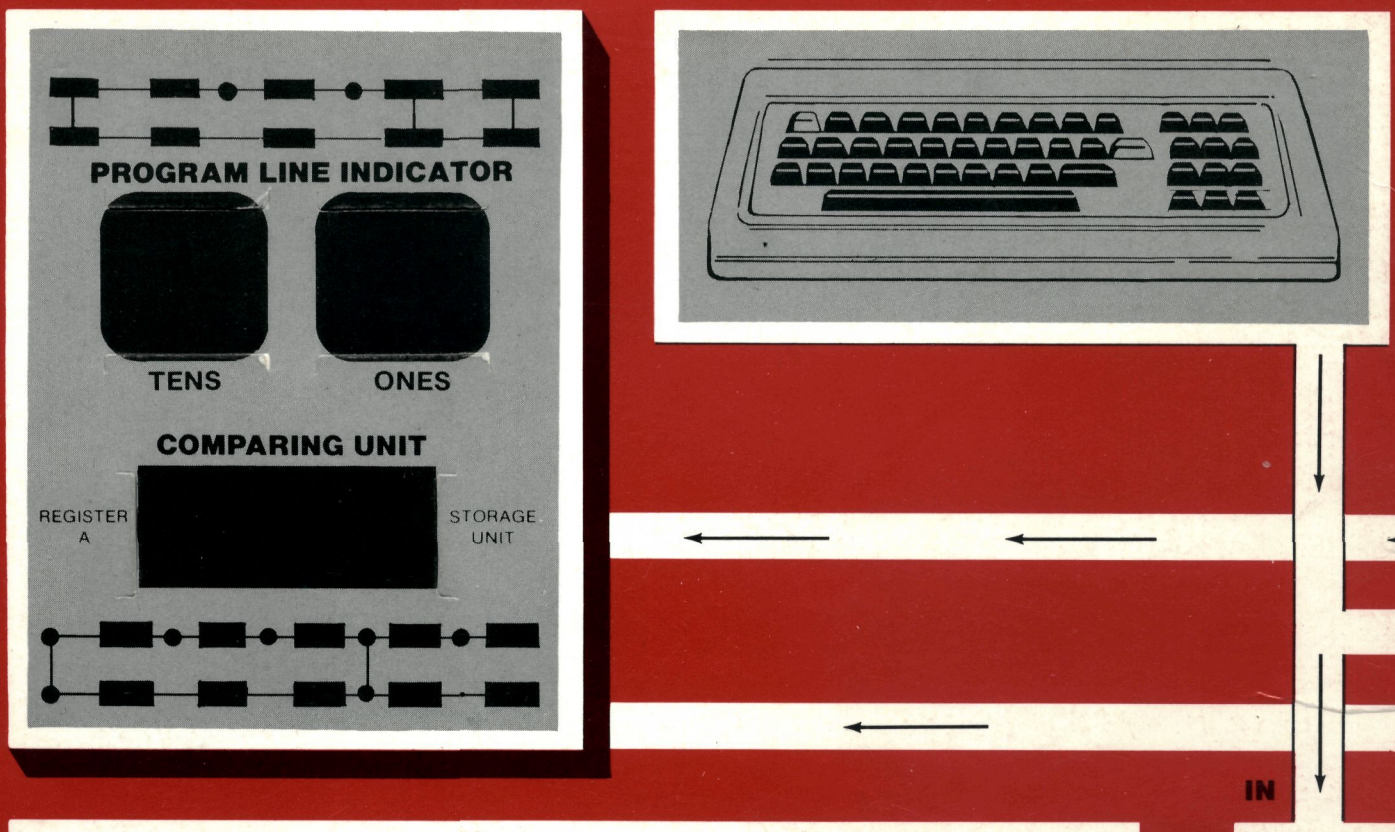
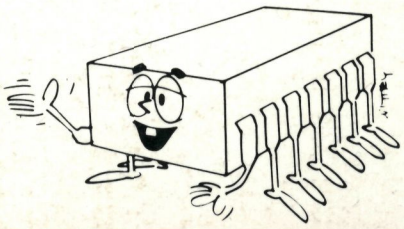


COMPUTER DEMONSTRATOR



Radio Shack

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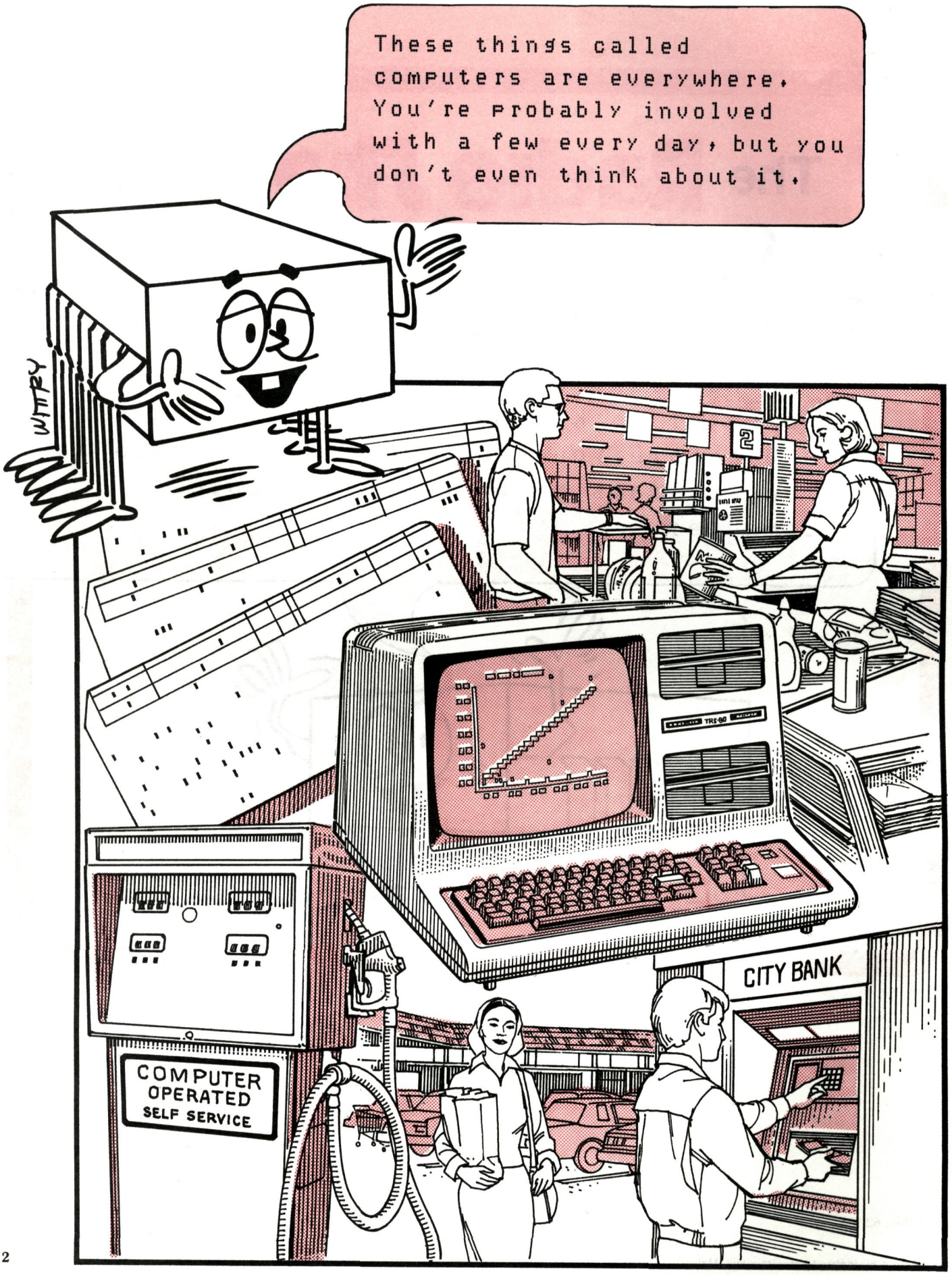
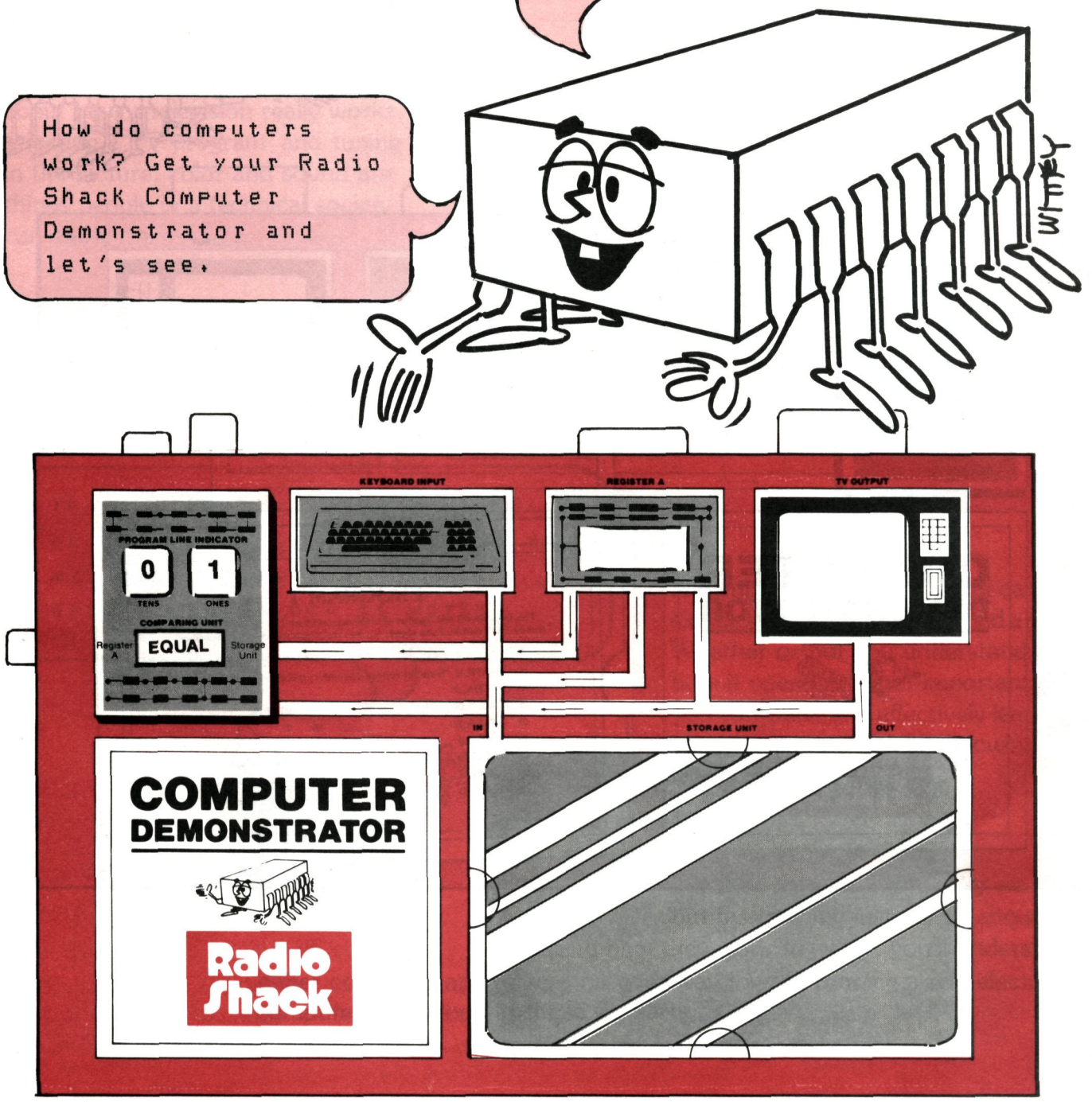

These things called computers are everywhere. You're probably involved with a few every day, but you don't even think about it.
WITTRY
COMPUTER OPERATED SELF SERVICE
CITY BANK

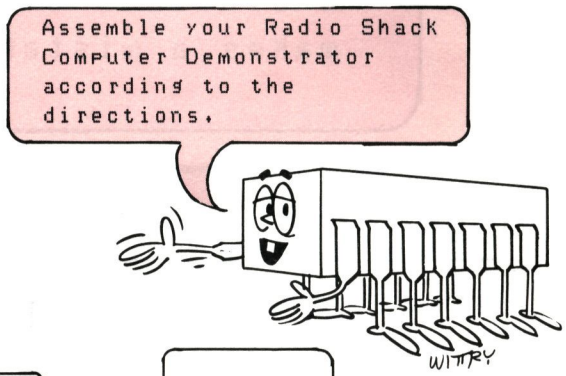
Computers are just machines. They don't think and feel as we do. But boy are they fast! Why, the modern computer can do almost a billion (1,000,000,000) operations a second, and it very seldom makes a mistake.

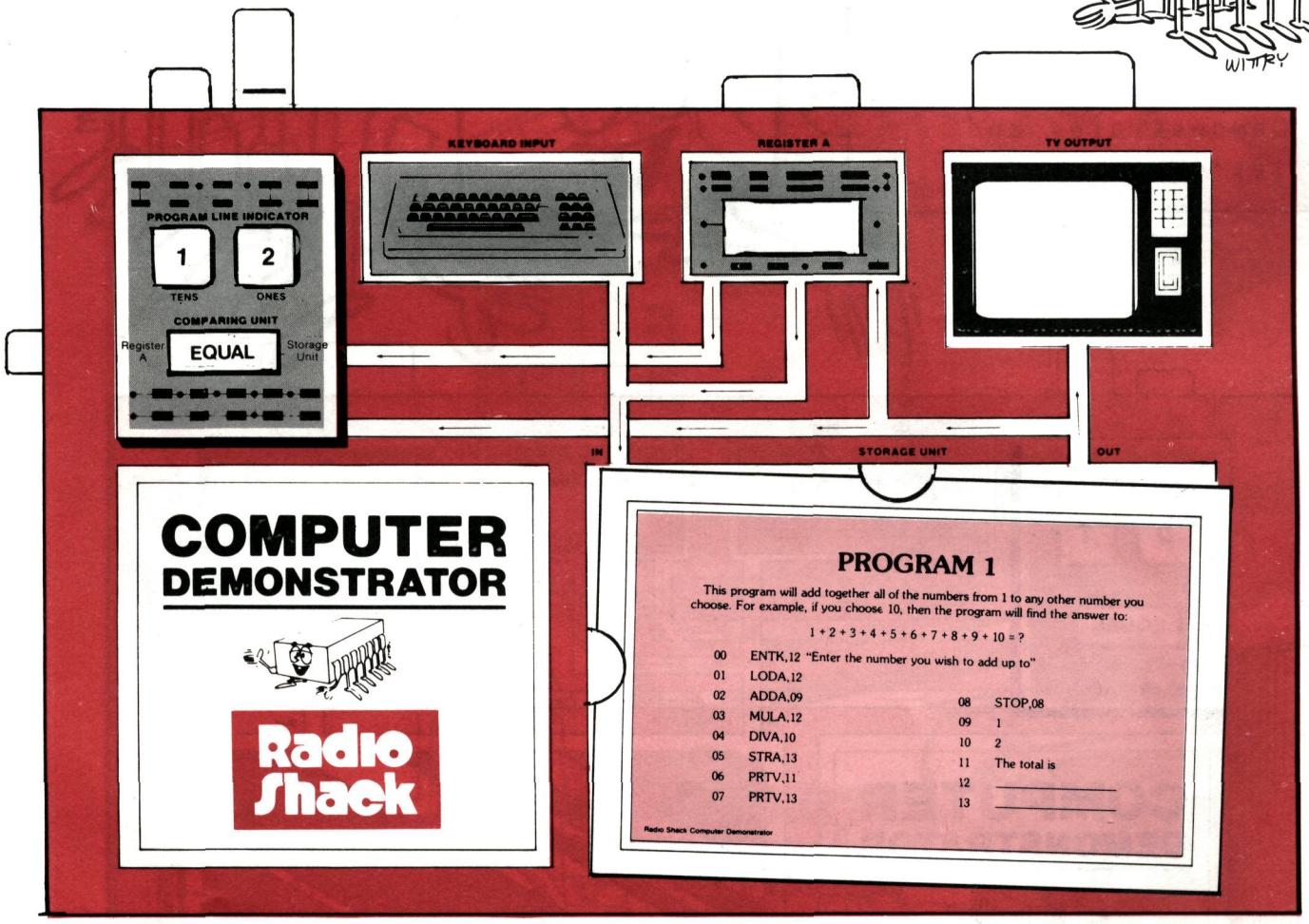
How do computers work? Get your Radio Shack Computer Demonstrator and let's see.



Assembly Directions for Your
RADIO SHACK COMPUTER DEMONSTRATOR

1. Carefully separate the five slides which are attached to your computer.
2. Place the slides in the computer as shown in the diagram below. (Thread the Comparing Unit slide from right to left so that the rounded end extends on the left side of the **Computer Demonstrator**.)
3. Attach programs to the Storage Unit by inserting the four sides of the program sheet under the half-circle tabs.

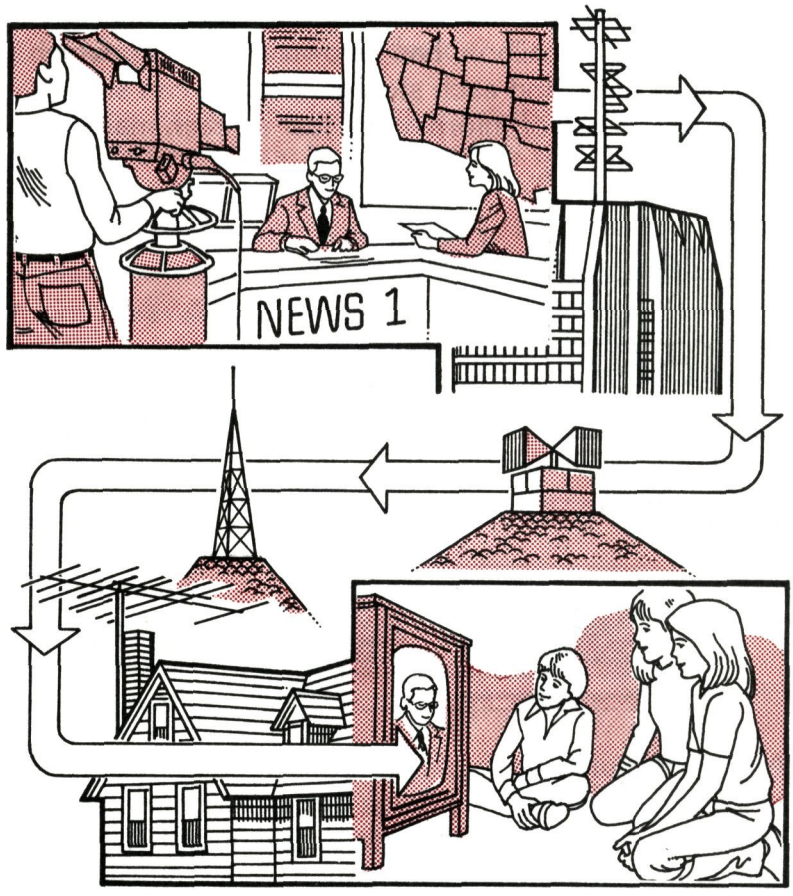


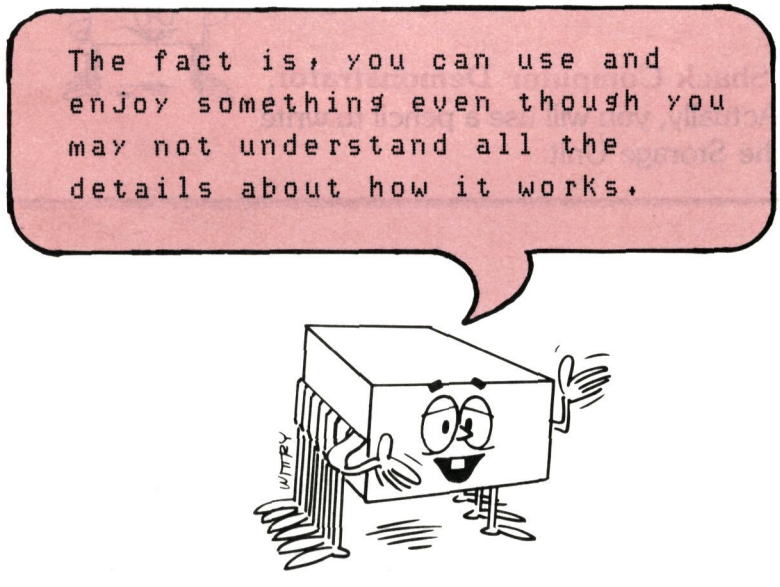


YOU'RE SMARTER THAN YOU THINK!

When you turn on a TV and tune in a program, just think of how many things are involved!

There are cameras and transmitters and antennas and electricity, as well as the TV set. And, although most people do not understand much about how a television really works, selecting a TV program and tuning in the picture, color and sound are things people in a technical society can easily do.



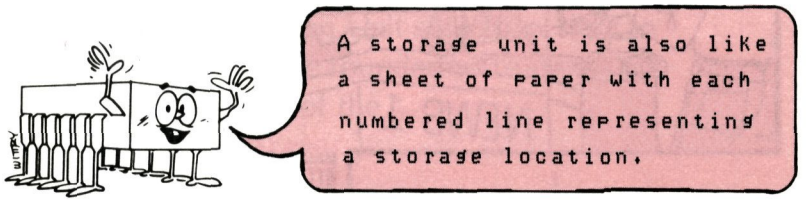


A computer is a machine that can follow a simple set of instructions called a program. Whether or not you understand exactly how it operates is not important because you can easily and effectively learn how to use a computer without knowing how it works inside.

Now, look at your **Computer Demonstrator.** It has only six parts; but by knowing just a little about each one and how they work together, you'll understand this paper computer and be well on your way toward running a real electronic computer. Let's look at these six parts.

1. STORAGE UNIT

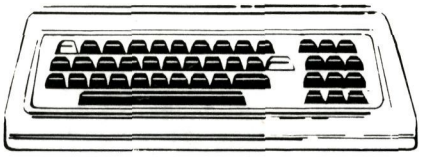
The storage unit of a computer consists of a large number of individual storage locations. It can be compared to a group of mailboxes at a post office. Each individual storage location, like a mailbox, has its own address by which it can be located; and each storage location can store a small bit of data or information, just as each mailbox can store a letter.



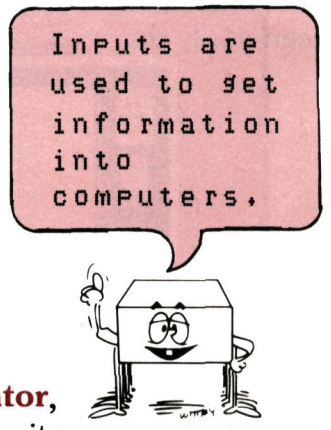
00	LODA,05
01	ADDA,06
02	STRA,07
03	PRTV,07
04	STOP,04
05	148
06	211
07	_____

In this example, storage location 00, or line 00, contains the information LODA,05. Location 01, or line 01, contains ADDA,06, and so on.

2. KEYBOARD INPUT



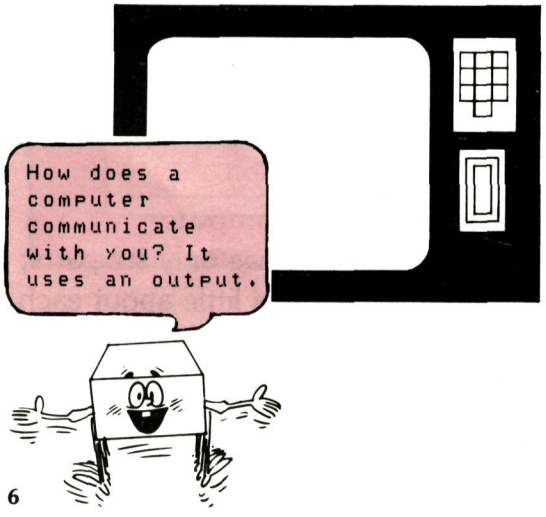
The purpose of a computer is to solve problems. To do so, it must have enough information entered into its storage unit to know what the problem is and how to solve it.



A keyboard unit is one of the most common ways of entering small amounts of information into the storage unit of a computer. The operation of a keyboard input is almost the same as the operation of a typewriter. The main difference is that keyed information from a typewriter ends up on a sheet of paper, while the same information from a keyboard input ends up in the storage unit of a computer.

When entering information into your **Radio Shack Computer Demonstrator**, you will pretend to use the Keyboard Input. Actually, you will use a pencil to write the information on some designated line of the Storage Unit.

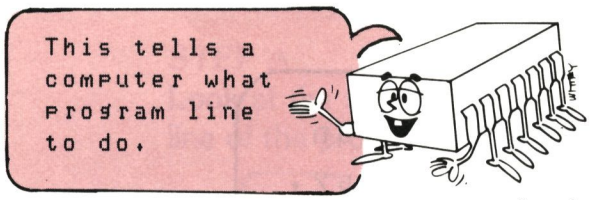
3. TV OUTPUT



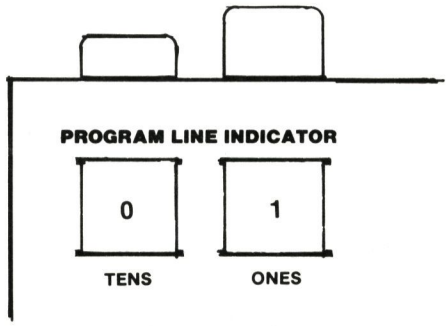
Once a computer has solved a problem, it needs a way to tell you what the answer is. It does this by using an output device, which is simply a means of getting information out of its storage unit so that you can read it. An ordinary TV screen provides an output for most modern computers.

Instead of a TV screen, your **Computer Demonstrator** uses a movable strip of cardboard labeled TV Output. If you are asked to print some information on the TV Output, write the information on the TV Output slide, raising the cardboard slide as clean writing space is needed.

4. PROGRAM LINE INDICATOR



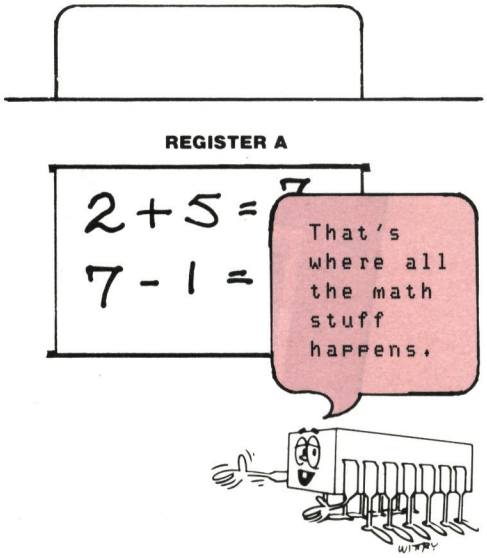
When a computer operates, it follows a step-by-step set of instructions, one at a time. This set of instructions is called the computer program, and it is entered into the storage unit using an input device.



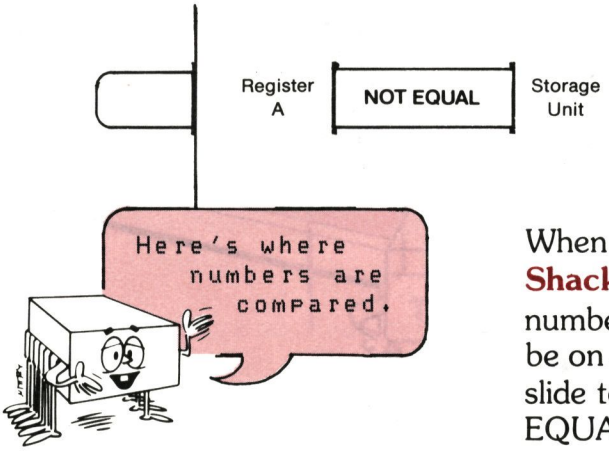
As the computer follows the instructions in its program, one line at a time, the Program Line Indicator keeps track of which program line is being done at any one time. The Program Line Indicator of your **Radio Shack Computer Demonstrator** uses two slides for this purpose. Move the slides to practice using the Program Line Indicator.

5. REGISTER A

Notice that your **Radio Shack Computer Demonstrator** has a small box at the top labeled Register A. All computers have registers. These are the places where arithmetic operations are done. Once a number is loaded into a register, that number can be added to, subtracted from, compared to, etc., some other number located on a storage line. You will use the register of your **Computer Demonstrator** by writing numbers on the cardboard strip and pulling the strip up as more room is needed.



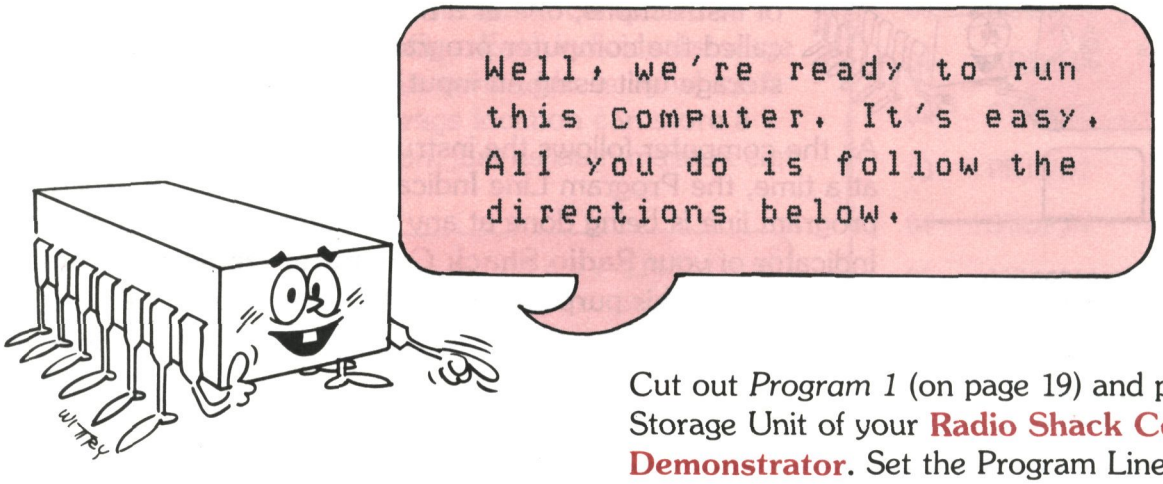
6. COMPARING UNIT



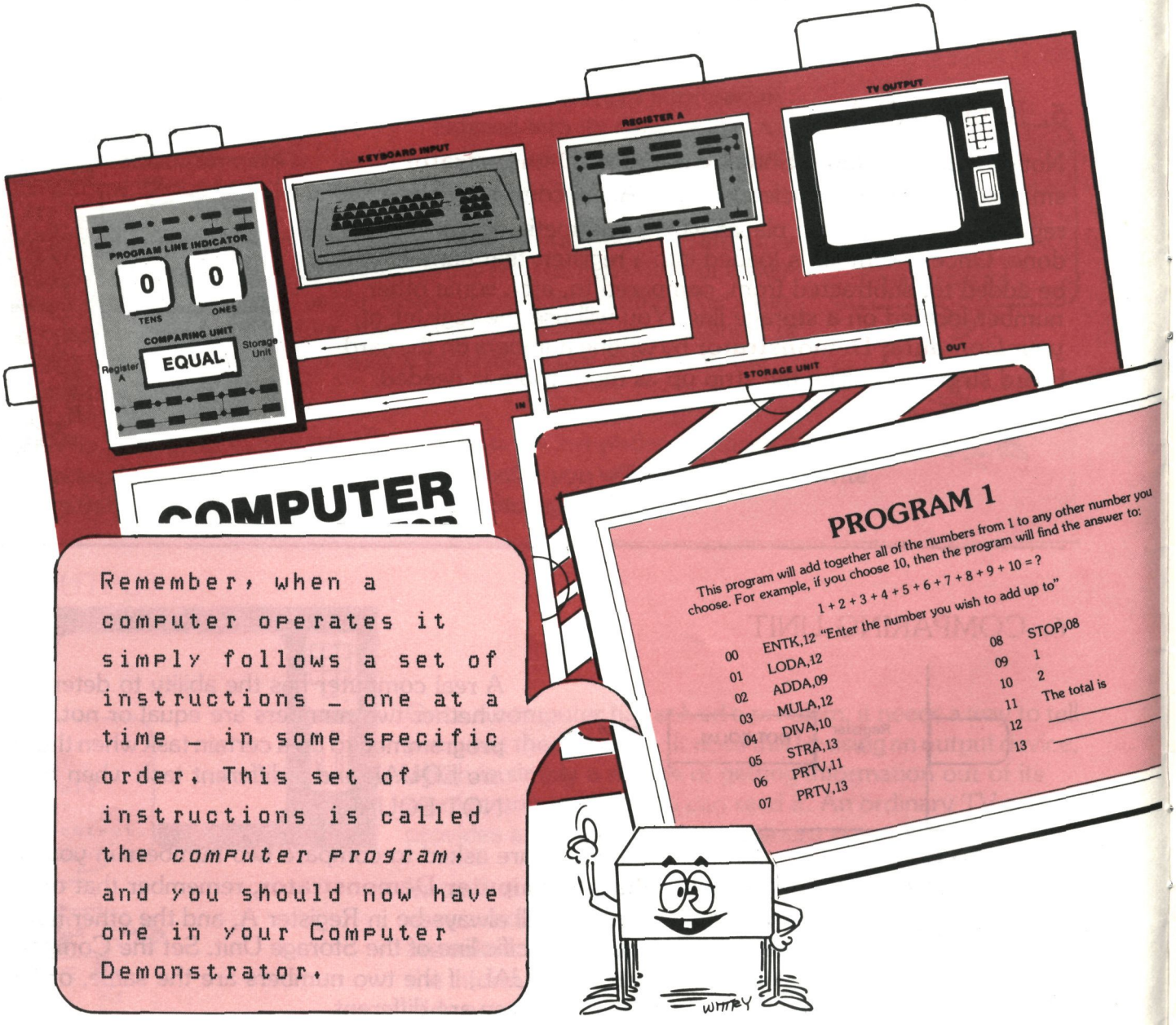
A real computer has the ability to determine whether two numbers are equal or not. It can be programmed to do a certain task when the numbers are EQUAL and a different task when they are NOT EQUAL.

When you are asked to compare two numbers in your **Radio Shack Computer Demonstrator**, remember that one of the numbers will always be in Register A, and the other number will be on a specific line of the Storage Unit. Set the Comparing Unit slide to EQUAL, if the two numbers are the same, or NOT EQUAL, if they are different.

RUNNING A COMPUTER PROGRAM



Cut out *Program 1* (on page 19) and place it into the Storage Unit of your **Radio Shack Computer Demonstrator**. Set the Program Line Indicator to 00.

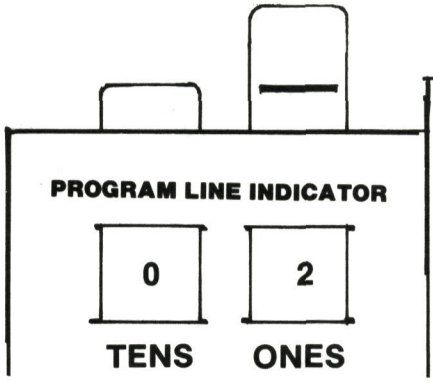


Remember, when a computer operates it simply follows a set of instructions _ one at a time _ in some specific order. This set of instructions is called the *computer program*, and you should now have one in your Computer Demonstrator.

Running a computer is easy. There are only three steps for doing each line of the program. It's as easy as A, B, C!

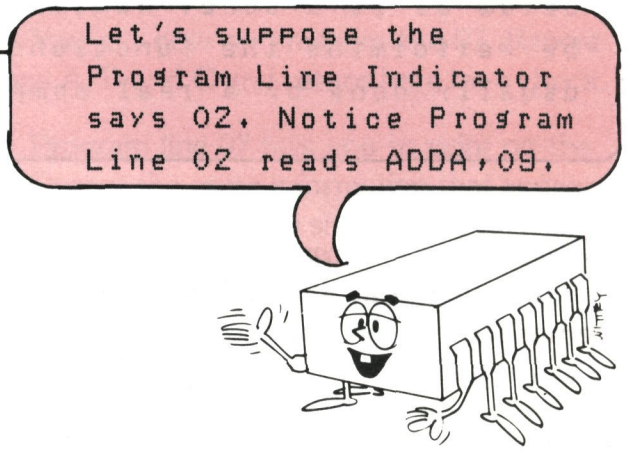
STEP A

Look at the number showing on the Program Line Indicator and find that numbered line of the program in the Storage Unit.



STORAGE UNIT

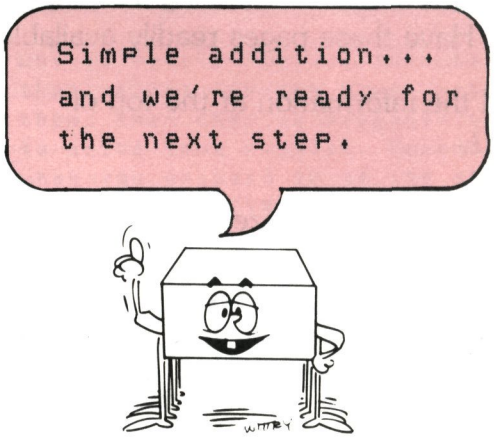
00 ENTK,12
01 LODA,12
02 ADDA,09
03 MULA,12
04 DIVA,10



STEP B

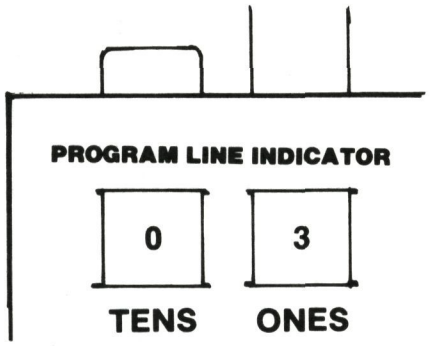
Use the list of *Computer Instruction Codes* on page 23 and do as instructed.

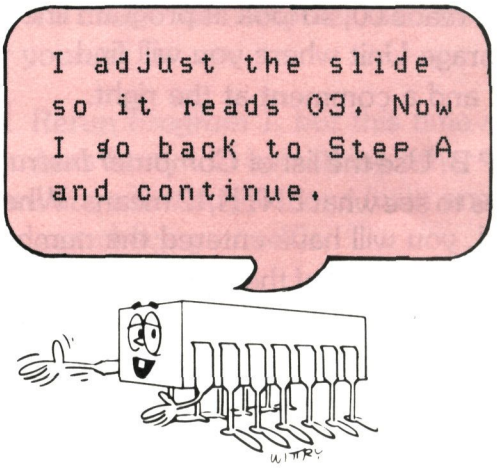
EXAMPLE:
ADDA,09 means, "Add to the number in Register A the number shown on line 09 of the computer program. Write the answer in Register A."



STEP C

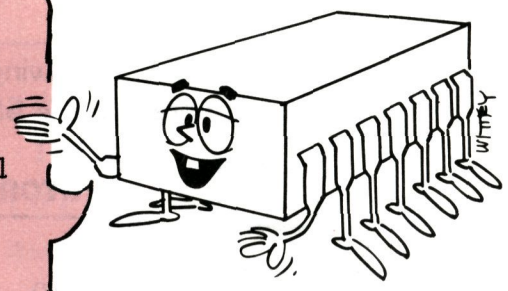
If the instruction in Step B did not change the number on the Program Line Indicator, add 1 to the Indicator by adjusting the slides.





RUNNING PROGRAM 1

You are ready to run Program 1. I'll take you through it step by step if you'll just check off each direction below as it's done. Remember, *you* will be performing the functions which are usually done by a real computer.



☐ Make sure *Program 1* is in the Storage Unit of your **Radio Shack Computer Demonstrator.** Set the Program Line Indicator to 00.

☐ Reference will be made to page 23 for the *Computer Instruction Codes,* and page 9 for steps A, B and C on *Running a Computer Program.* Have these pages readily available.

☐ Read the information at the top of *Program 1.*

☐ You should now realize that this program is designed to add 1 + 2 + 3 + 4 +..., up to any chosen number. For your first try, choose 10. In other words, you will have the Computer add together all the numbers from 1 to 10.

☐ Remember steps A, B and C on *Running a Computer Program?* These steps will now be followed for each line of *Program 1.*
STEP A. Look at the Program Line Indicator on your **Radio Shack Computer Demonstrator.** It reads 00, so look at program line 00 in the Storage Unit where you will find ENTK,12 and a comment at the right.

☐ **STEP B.** Use the list of *Computer Instruction Codes* to see what ENTK,12 means. When completed, you will have entered the number 10 on program line 12 of the Storage Unit. This is because it was the first ten numbers which were to be added together for your first try at running a program.

☐ **STEP C.** The ENTK,12 *Computer Instruction Code* just completed did not change the number in the Program Line Indicator, so add 1 to the Indicator by raising the slide to make the slides read 01.

☐ **STEP A.** The Program Line Indicator now reads 01, so look at program line 01. There you will find LODA,12.

☐ **STEP B.** Find out what LODA,12 means by using the *Computer Instruction Code List.* In this step you will write a 10 in Register A because program line 12 has 10 written on it.

☐ **STEP C.** LODA,12 didn't change the number in the Program Line Indicator, so add 1 to its count.

☐ **STEP A.** The Program Line Indicator reads 02. This directs you to program line 02, where you will find ADDA,09. Verify this.

☐ **STEP B.** Step B of *Running a Computer Program* directs you to figure out what ADDA,09 means and do it. Refer to your *Computer Instruction Code List* and perform the operation as instructed. When done, there should be an 11 in Register A, since the 1 on program line 09 was added to the 10 already in Register A, leaving 11 as the total.

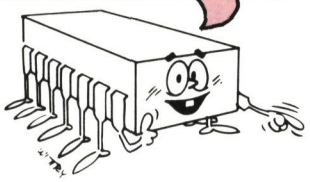
☐ **STEP C.** ADDA,09 didn't change the number in the Program Line Indicator, so just add 1 to its count, making the reading 03.

☐ **STEP A.** The Program Line Indicator reads 03. Look at program line 03 to see what's there. You will find MULA,12.

☐ **STEP B.** Look up MULA,12 on the *Computer Instruction Code List* and do what it says. When done, Register A should read 110. This is because the 11 in Register A was multiplied by the 10 on program line 12, giving 10 x 11 or 110.

☐ **STEP C.** The MULA,12 instruction you just completed didn't change the Program Line Indicator, so add 1 to the Indicator, increasing its count to 04.

```
Are you getting the idea? Each line of
the program requires three simple steps.
STEP A: Read the Program Line Indicator to
        see what program line is to be
        done.
STEP B: Go to that program line and do
        whatever the Computer Instruction
        Code there directs.
STEP C: Adjust the Program Line Indicator
        and go back to Step A.
```



☐ Your Program Line Indicator should still read 04. See if you can do Steps A, B and C. If everything works out all right, the 110 in Register A will have been divided by the 2 on program line 10, leaving the answer 55 in Register A. Your Program Line Indicator will read 05.

☐ Do program line 05 for yourself, following Steps A, B and C. Then return here for a check.

☐ STRA,13 required you to store the number in Register A on program line 13, so you should have written 55 on program line 13. Also, 1 should have been added to the Program Line Indicator, making it read 06.

☐ Repeat Steps A, B and C again and return here for a check.

☐ The words The total is should have been printed on the strip of cardboard in the TV Output. This is because PRTV,11 tells you to print on the TV Output the same thing that appears on program line 11. The Program Line Indicator reading should be 07.

☐ You are now on program line 07. Repeat Steps A, B and C and return here for a check.

☐ Program line 07 tells you to print on the TV Output the same information that appears on program line 13. You should have raised the cardboard in the TV Output and printed the number 55. The Program Line Indicator should read 08.

☐ When attempting to do Steps A, B and C again, Step B will instruct the computer to stop. Verify this.

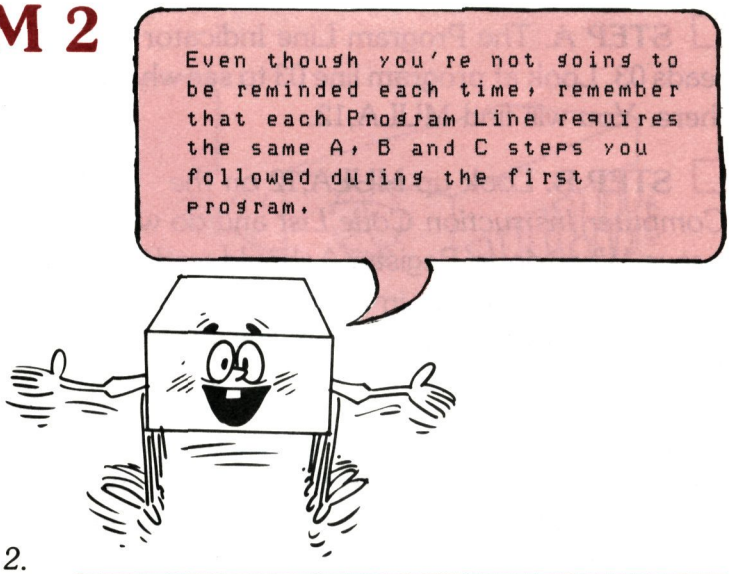
```
Why do people operate computers? If
they're not playing games with
them, then they're probably trying
to solve some problem. Remember
when you entered 10 at the start of
this program? That was because you
wanted the Computer to find the
answer to 1 + 2 + 3 + 4 + 5 + 6 + 7
+ 8 + 9 + 10. Pull out the
cardboard strip on the TV Output.
It should read: The total is 55.
```

☐ Do the first 10 numbers really add up to 55? To check the computer, add the numbers for yourself.

☐ Rerun *Program 1*, but this time add the numbers from 1 to something other than 10. Here are a few suggestions (with answers so you can check yourself):

The total for the numbers from 1 to 21 is 231.
The total for the numbers from 1 to 37 is 703.
The total for the numbers from 1 to 64 is 2080.
The total for the numbers from 1 to 261 is 34,191.

RUNNING PROGRAM 2



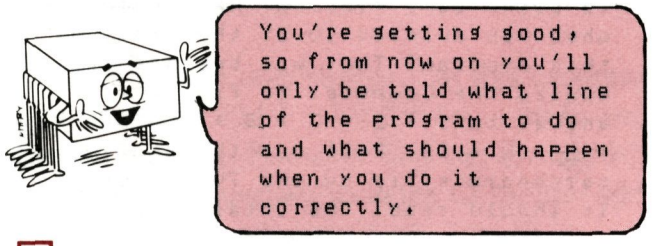
☐ Put *Program 2* in the Storage Unit of your **Radio Shack Computer Demonstrator.** Set the Program Line Indicator to 00 and pull up the cardboard strips in Register A and the TV Output so that you have clean writing area.

☐ You'll need your list of *Computer Instruction Codes* on page 23. By now you should know the three basic steps for running a computer program. If there is any doubt, review them on page 9.

☐ Read the information at the top of *Program 2.*

☐ As an example, suppose the radio weatherperson tells you it is 20 degrees Celsius outside. What does this temperature equal in Fahrenheit degrees? To find out, enter a 20 when doing line 00 of the program.

☐ If you started correctly, program line 14 should have a 20 written on it, and the Program Line Indicator should read 01.



☐ Do program line 01. When completed, Register A should have 20 in it, and the Program Line Indicator will read 02.

☐ Do program line 02. If everything is done correctly, Register A will contain 180, since 9 x 20 = 180.

☐ Do program line 03. After dividing the number in Register A by the 5 on program line 11, the answer 36 will end up in Register A.

☐ Do program line 04. When done, the 32 on program line 13 will have been added to Register A, leaving 68 there.

☐ Do program line 05. This stores the number in Register A on line 15, so 68 will be written on that line.

☐ Do program line 06. It takes the number on line 14 and prints it on the TV Output. Thus, 20 will be printed on the TV Output.

☐ Do program line 07. This will print degrees Celsius = on the TV Output.

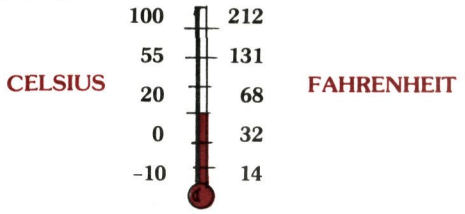
☐ Do program line 08. This will cause the number on line 15 to be printed on the TV Output. In this example, 68 will be printed.

☐ Do program line 09. It will cause degrees Fahrenheit. to be printed on the TV Output.

☐ There's not much to say about program line 10; it stops the Computer. After this occurs, raise the cardboard strip in the TV Output and read

20
degrees Celsius=
68
degrees Fahrenheit.

☐ Run the program a few times using different Celsius temperatures each time. Here are a few suggestions, with answers so you can check your work.

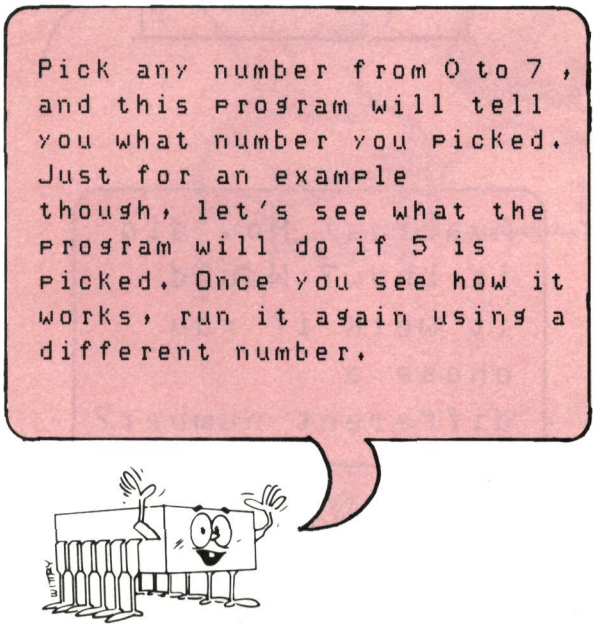


RUNNING PROGRAM 3

☐ Put *Program 3* in the Storage Unit of your **Radio Shack Computer Demonstrator.** Set the Program Line Indicator to 00 and pull up the cardboard strips in Register A and the TV Output so that you have clean writing area.

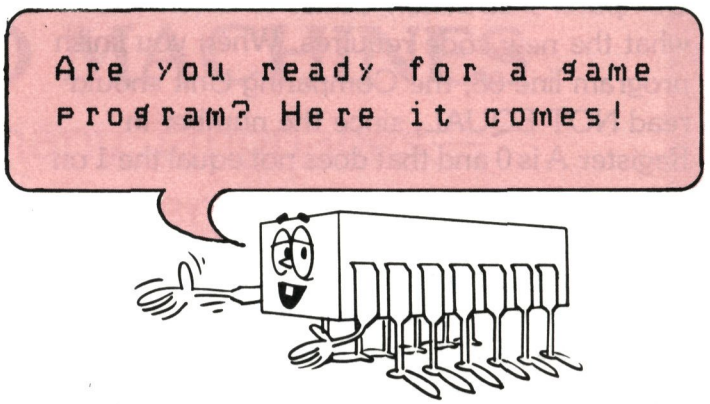
☐ Read the information at the top of *Program 3.*

☐ The "Pick-a-Number Game" on an electronic computer would probably give you a a few hundred numbers from which to choose, but our object here is simplicity. That's why only the numbers 0 to 7 are used.



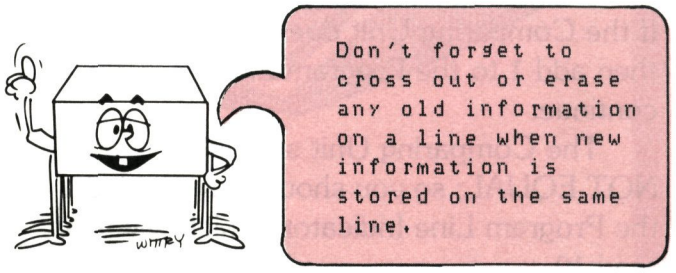
☐ Do program line 00. When completed, a 4 should be in Register A, and the Program Line Indicator should read 01.

☐ Do program line 01, which asks you to enter information on line 20 of the Storage Unit. The information required is a 1 if the answer to the question below is *yes,* or a 0 if the answer is *no.* Since the question on program line 01 asks whether or not the number you chose is in the bucket, a 1 is written on program line 20—indicating that *yes,* our number 5 *is in the bucket.*



☐ Do program line 02. When completed, the 4 in Register A will have been multiplied by the 1 on program line 20, leaving a 4, since 1 x 4 = 4.

☐ Do program line 03. This is similar to program line 01, only now the question is whether or not the chosen number is in the box. Write a 1 on line 20, indicating *yes,* the chosen number 5 *is in the box.*



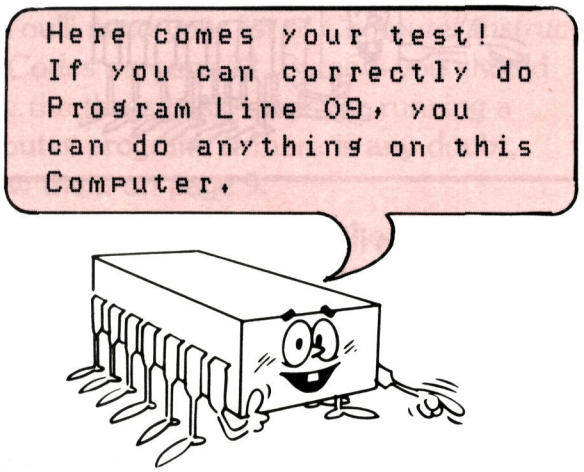
☐ Do program line 04. When finished, the 1 on line 20 will have been added to the 4 already in Register A, leaving Register A with a total of 5.

☐ Do program line 05, which tells you to store (write) the 5 in Register A on line 21 of the Storage Unit.

☐ Do program line 06. This is also similar to program line 01, only the question asks if the chosen number is in the bottle. After crossing out old information, write 0 on line 20, indicating that the chosen number 5 *is not in the bottle.*

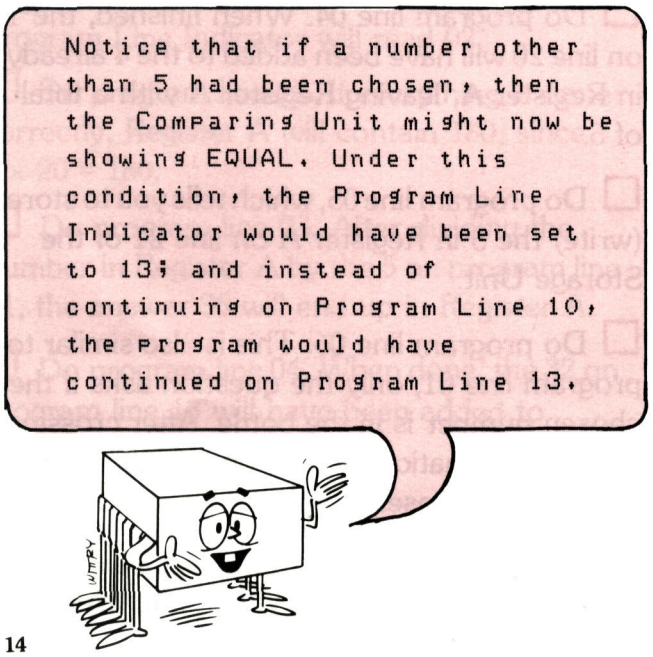
☐ Do program line 07. When completed, 0 ends up in Register A.

☐ Do program line 08. Refer to the list of *Computer Instruction Codes* to determine what the new code requires. When you finish program line 08, the Comparing Unit should read NOT EQUAL, since the number in Register A is 0 and that does not equal the 1 on program line 17.



☐ Do program line 09. IAEQ,13 means that if Register A shows EQUAL on the Comparing Unit, then set the Program Line Indicator to 13. If the Comparing Unit doesn't show EQUAL, then add 1 to the Program Line Indicator and continue.

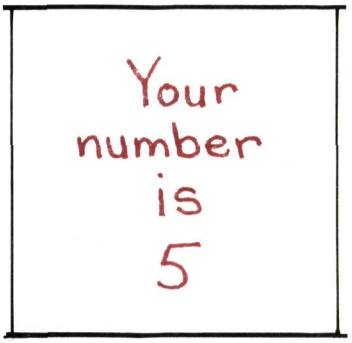
The Comparing Unit should be showing NOT EQUAL; so you should have added 1 to the Program Line Indicator, which will now read 10.

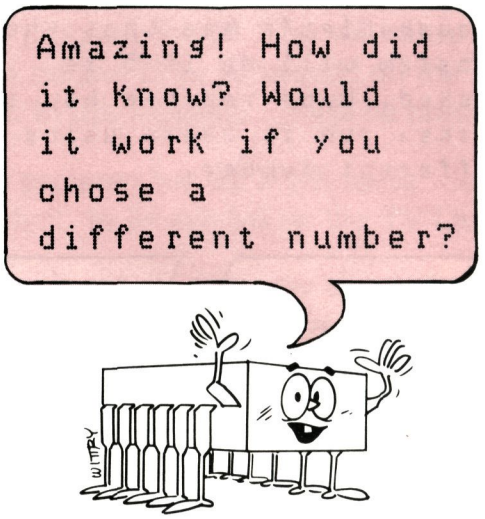


☐ Do program line 10. It causes Your number is to be printed on the TV Output.

☐ Do program line 11. It causes the 5 on line 21 to be printed on the TV Output.

☐ Program line 12 directs you to stop. Pull up the strip of cardboard in the TV Output and you should read:

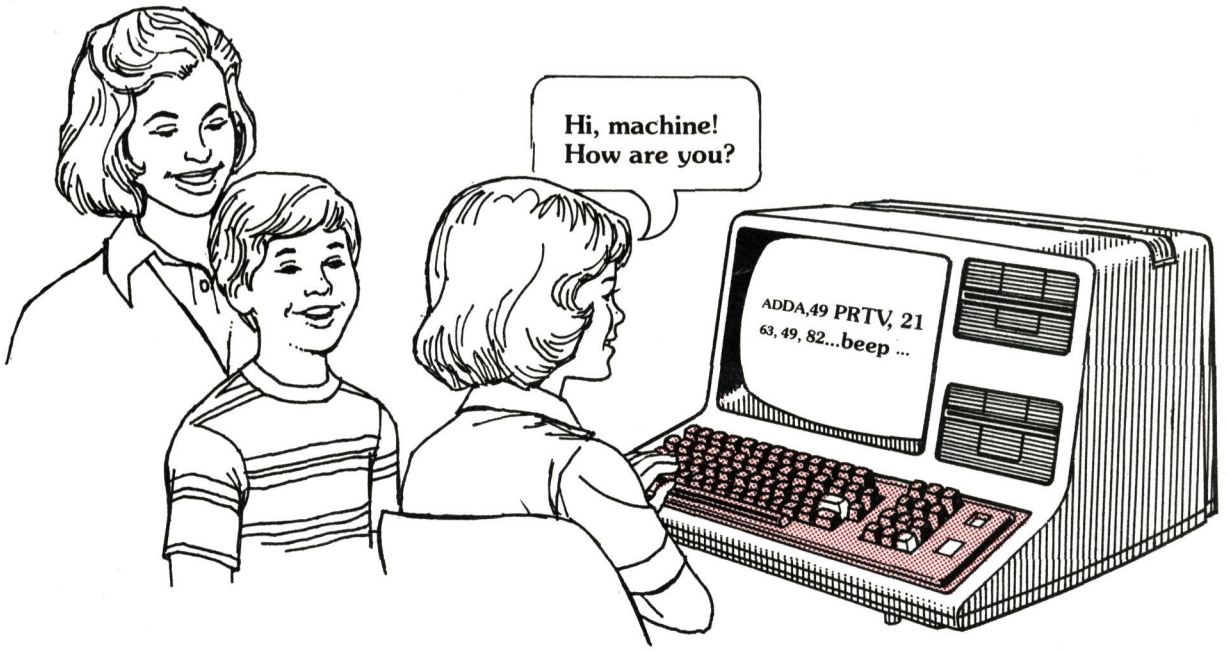




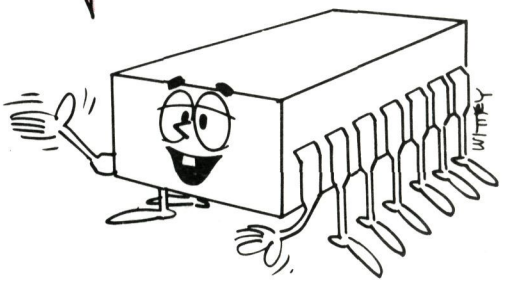
☐ Run *Program 3* again, but choose a different number and see what happens.

TALKING TO MACHINES

People speak many languages— so do computers.



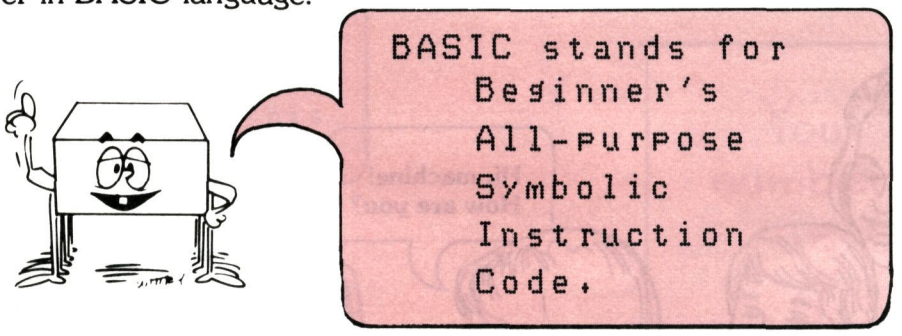
It's easy to use a computer. All you have to do is know how to talk to it, and that means learning its language.

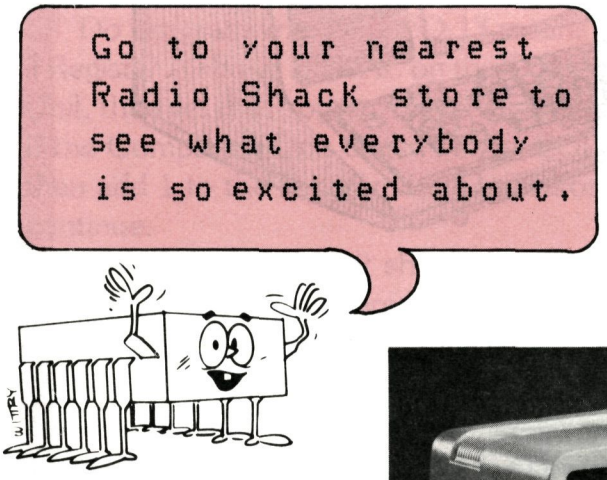


It may come as a surprise, but you already know at least one computer language. It's the language for your **Radio Shack Computer Demonstrator**. There are only 13 words in it. Technically, it might be called a "pseudo assembly language," but we just refer to it as a list of *Computer Instruction Codes*.

Here's another surprise. There are even easier computer languages to use. One of them is called BASIC, and it is used by most of the small computer systems in the world.

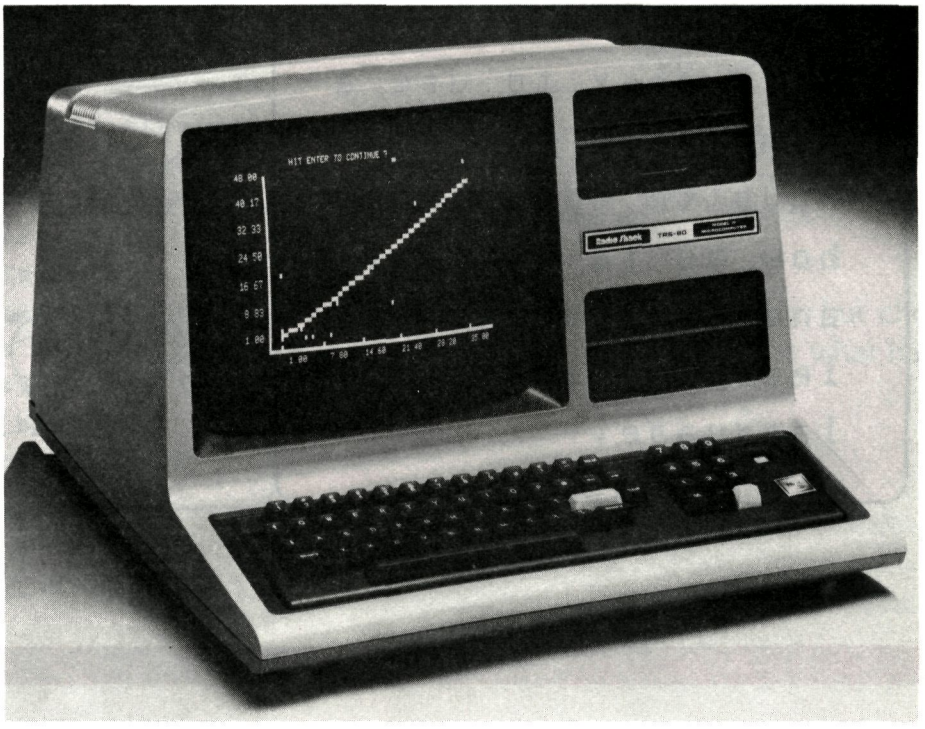
If you can speak English, then you can talk to a computer in BASIC language.



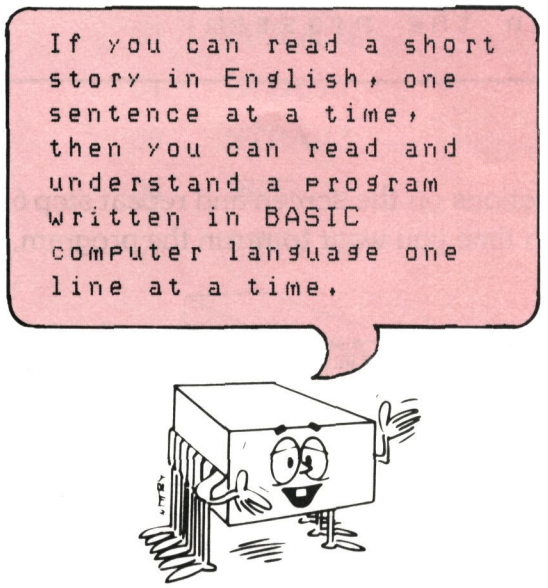


Almost everyone has heard of or seen the Radio Shack TRS-80 microcomputer system. You may even know people who have a TRS-80 at home.

In its simplest form, the TRS-80 has a 12" TV as its output and a standard typewriter keyboard as its input. It uses BASIC computer language, and that makes running a TRS-80 not only easy, but fun.

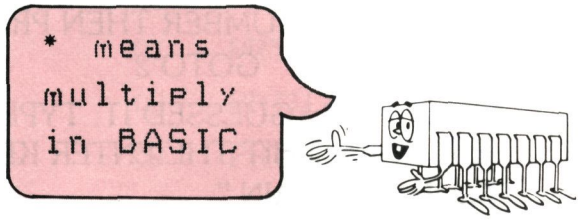


BASIC programs on the Radio Shack TRS-80 computer are very similar to the programs you have run on your **Radio Shack Computer Demonstrator**. In fact, BASIC programs are even easier because English words and symbols are used. Operation of the Program Line Indicator, the Comparing Unit, Register A, etc., are all automatic; and the TRS-80 does most of the work that your brain and hand did on your **Computer Demonstrator**.



Remember the first program you ran on your **Computer Demonstrator**? It added together the numbers 1 + 2 + 3 + 4..., up to any chosen number. Here's one way the same program can be written in BASIC computer language:

```
00    CLS
01    PRINT "ENTER THE NUMBER YOU
      WISH TO ADD UP TO"
02    INPUT NUMBER
03    SUM = NUMBER * (NUMBER + 1)/2
04    PRINT "THE TOTAL IS "; SUM
05    STOP
```



How does this program work?

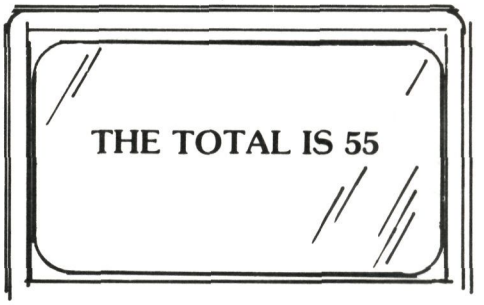
Program line 00 has CLS on it, which clears the screen on the TRS-80 TV Output. It's like putting a clean strip of cardboard in the TV Output of your **Computer Demonstrator.**

Program line 01 actually prints the sentence in the quotation marks on the TV Output screen. So ENTER THE NUMBER YOU WISH TO ADD UP TO will appear on the TV.

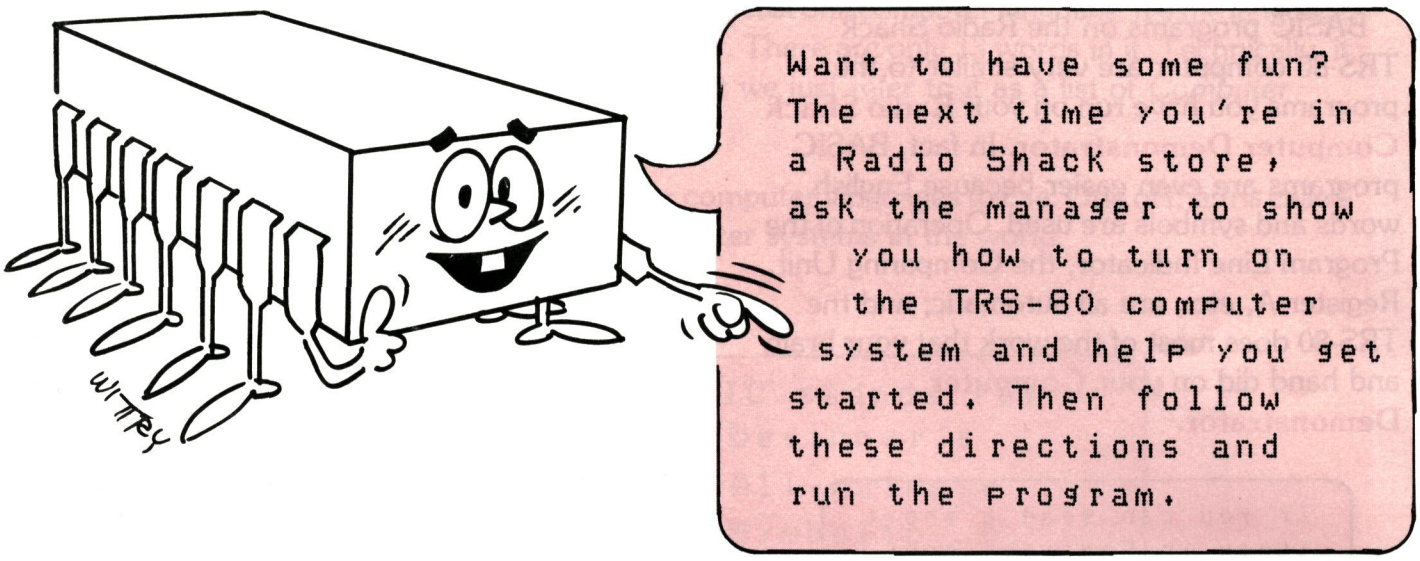
Program line 02 will cause a ? to appear on the TV Output screen. This is your cue to enter some information through the keyboard input. Type any number; then hit the big white ENTER key.

Program line 03. Since * means multiply, this line will take the number you entered, multiply it by 1 more than itself and divide the result by 2. The answer will then be given the name SUM.

Program line 04 will print the statement within the quotation marks and also print the numeric value of SUM from line 03. On the TV screen it will look like this:



Program line 05 stops the TRS-80 computer.



1. Make sure the TRS-80 is on. Look for the little red light on the keyboard. Make sure the TV Output is also on.

2. Hit the BREAK key. Then hit the white ENTER key.

3. Hit the CLEAR key and the TV screen will clear.

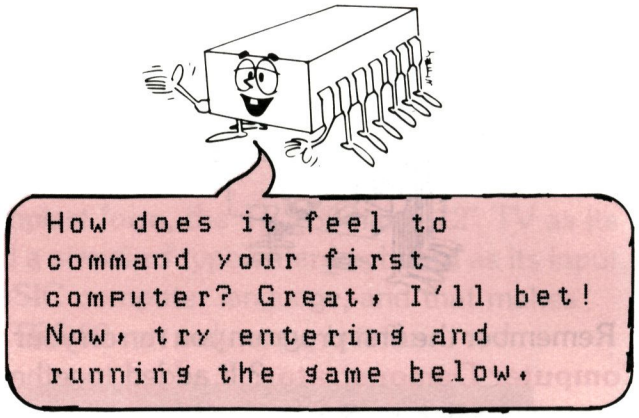
4. Type each line of the last program exactly as it appears on page 17, hitting the white ENTER key after each line. If you make a mistake, just retype and enter the entire line, or use the ← key to backspace and erase.

As an example, line 00 would be entered as follows:

Type 00
Hit the space bar
Type CLS
Hit the white ENTER key

5. Hit the CLEAR key, type LIST and hit the white ENTER key to recheck your program for errors. If there are any, just retype and enter the incorrect line. Then repeat step 5.

6. Type RUN and hit the white ENTER key and you are on your way. Follow the instructions on the screen and repeat step 6 each time you want to rerun the program.



PICK-A-NUMBER GAME

```
00    CLS
01    NUMBER = RND (1000)
02    PRINT
03    INPUT "WHAT NUMBER AM I
      THINKING OF"; GUESS
04    IF GUESS < NUMBER THEN PRINT
      "TOO LOW":  GOTO 2
05    IF GUESS > NUMBER THEN PRINT
      "TOO HIGH":  GOTO 2
06    PRINT "YOU GUESSED IT. TYPE
       R U N AND HIT THE ENTER KEY
      TO PLAY AGAIN."
07    END
```

PROGRAM 1

This program will add together all of the numbers from 1 to any other number you choose. For example, if you choose 10, then the program will find the answer to:

1 + 2 + 3 + 4 + 5 + 6 + 7 + 8 + 9 + 10 = ?

```
00  ENTK,12  "Enter the number you wish to add up to"
01  LODA,12
02  ADDA,09
03  MULA,12
04  DIVA,10
05  STRA,13
06  PRTV,11
07  PRTV,13
08  STOP,08
09  1
10  2
11  The total is
12  _____
13  _____
```


PROGRAM 2

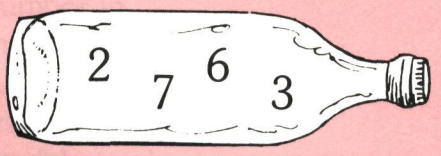
This program will convert a metric temperature in degrees Celsius to its equivalent English temperature in degrees Fahrenheit.

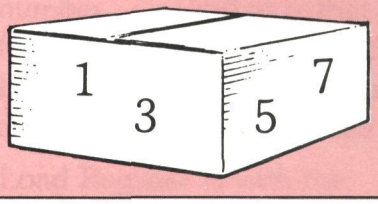
```
00  ENTK,14  "Enter the Celsius temperature"
01  LODA,14
02  MULA,12
03  DIVA,11
04  ADDA,13
05  STRA,15
06  PRTV,14
07  PRTV,16
08  PRTV,15
09  PRTV,17
10  STOP,10
11  5
12  9
13  32
14  _____
15  _____
16  degrees Celsius =
17  degrees Fahrenheit.
```

PROGRAM 3 PICK-A-NUMBER GAME

This is a simple demonstration of how a computer might appear to read your mind. Pick any number from 0 to 7. Then see where your number appears in the containers shown. Your **Radio Shack Computer Demonstrator** will ask you three questions about the number. Enter a 1 if the answer is YES; enter a 0 if the answer is NO.

```
00 LODA,18
01 ENTK,20
     "Is your number
     in the bucket?"
02 MULA,20
03 ENTK,20
     "Is your number
     in the box?"
04 ADDA,20
05 STRA,21
06 ENTK,20
     "Is your number
     in the bottle?"
07 LODA,20
08 CPRA,17
09 IAEQ,13
10 PRTV,19
11 PRTV,21
12 STOP,12
13 ADDA,17
14 ADDA,21
15 STRA,21
16 GOTO,10
17 1
18 4
19 Your number is
20 _____
21 _____
```

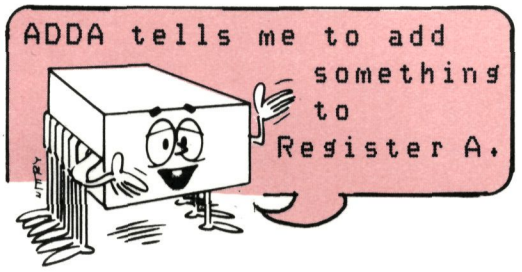




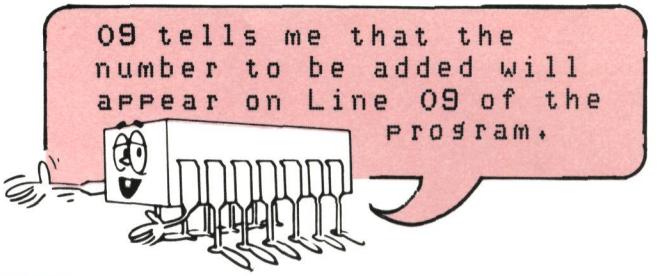
Radio Shack Computer Demonstrator

COMPUTER INSTRUCTION CODES

Each of the computer instruction codes below consists of four letters and a comma followed by two spaces for a number from 00 to 99. In an actual computer program, the letters will tell you what to do, and the two numbers will indicate which line of the storage unit is involved.



Example:
ADDA,09



ADDA, __ Add to the number in Register A the number shown on line __ of the computer program. Write the answer in Register A.

CPRA, __ Compare the number in Register A to the number shown on line __ of the computer program. Set the Comparing Unit slide to show whether the numbers are EQUAL or NOT EQUAL.

DIVA, __ Divide the number in Register A by the number shown on line __ of the computer program. Write the answer in Register A.

ENTK, __ Enter information from the Keyboard Input and write that information on line __ of the computer program. Erase or cross out any old information that may be on the line.

GOTO, __ Set the slides of the Program Line Indicator to the number __ and go to that line for the next instruction code.

IAEQ, __ If Register A shows EQUAL on the Comparing Unit, set the slide of the Program Line Indicator to the number __ and go to that line for the next instruction code. If Register A does not show equal, continue as if nothing had happened.

IANE, __ If Register A shows NOT EQUAL on the Comparing Unit, set the slides of the Program Line Indicator to the number __ and go to that line for the next instruction code. If EQUAL is showing continue as if nothing had happened.

LODA, __ Load Register A with the number shown on line __ of the computer program.

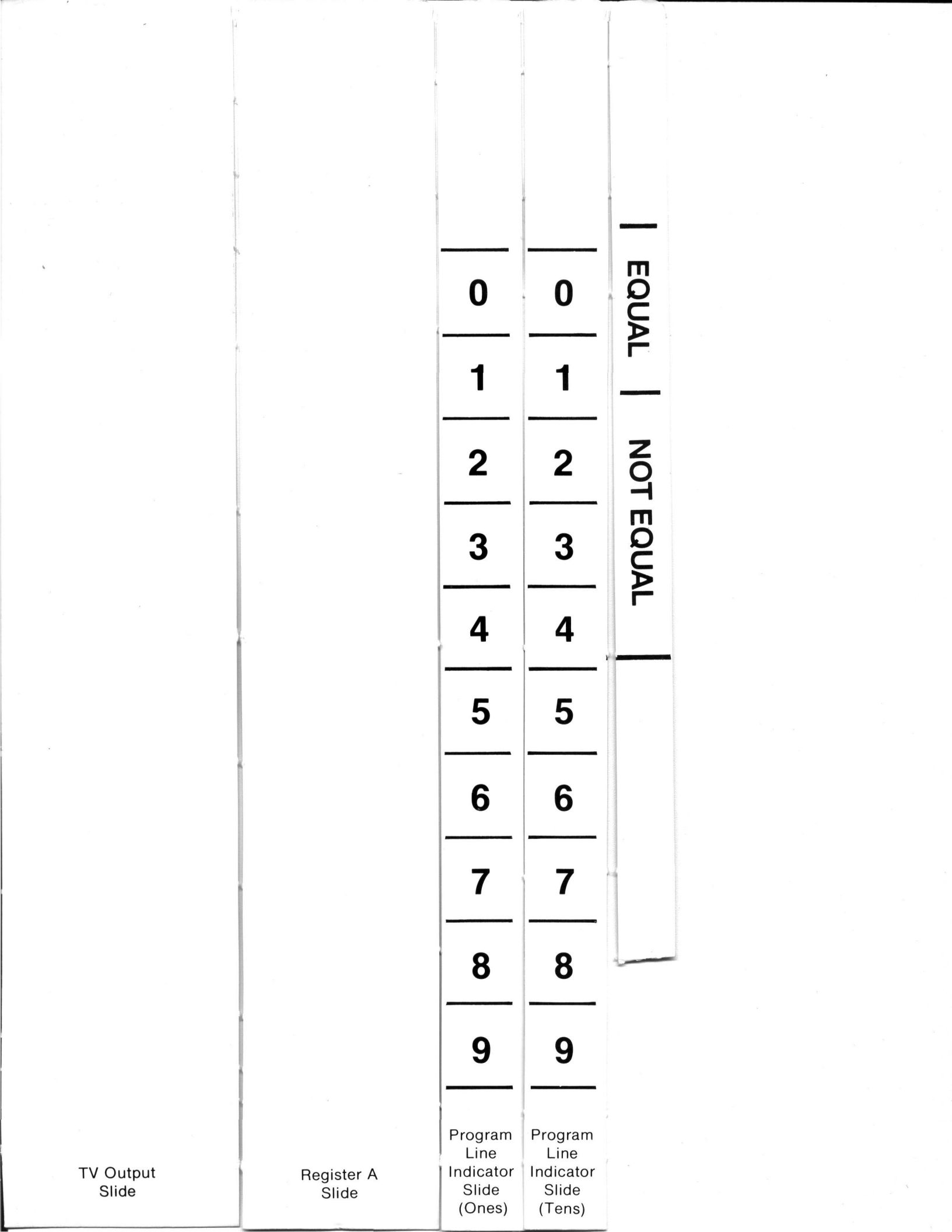
MULA, __ Multiply the number in Register A by the number shown on line __ of the computer program. Write the answer in Register A.

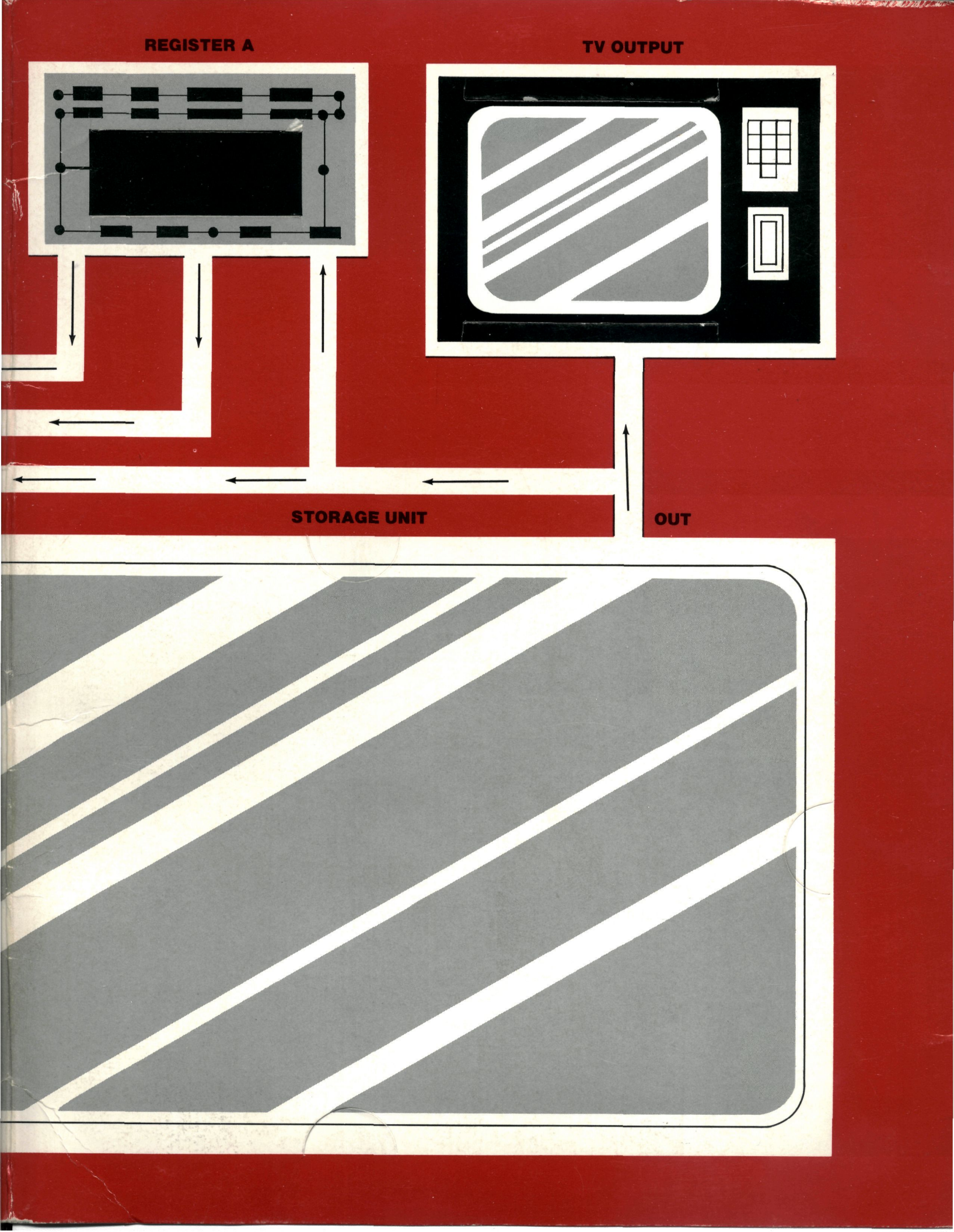
PRTV, __ Print on the TV Output the information shown on line __ of the computer program.

STOP, __ Stop running the computer program. Set the Program Line Indicator to the number __ ; then look on the TV Output slide for a message.

STRA, __ Store the information in Register A on line __ of the computer program. Erase or cross out any old information that may be on the line.

SUBA, __ Subtract from the number in Register A the number shown on line __ of the computer program. Write the answer in Register A.


EQUAL
NOT EQUAL
0
1
2
3
4
5
6
7
8
9
0
1
2
3
4
5
6
7
8
9
TV Output Slide
Register A Slide
Program Line Indicator Slide (Ones)
Program Line Indicator Slide (Tens)


REGISTER A
TV OUTPUT
STORAGE UNIT
OUT